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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Capped electric lamp and low-pressure mercury-vapor discharge lamp

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Capped electric lamp and low-pressure mercury-vapor discharge lamp

The invention relates to a capped electric lamp comprising:

a light-transmitting lamp vessel accommodating an electrical element,

a lamp cap provided with a projecting contact pin having a longitudinal axis, which lamp cap is secured to the lamp vessel,

a current-supply conductor which is connected to the electrical element and to the contact pin,

an indentation being formed in the contact pin to fix the current-supply conductor.

The invention also relates to a low-pressure mercury vapor discharge lamp comprising such a capped electric lamp.

An electric lamp as described in the opening paragraph is disclosed in WO-A 01/63 638 (PH-NL 00 0056). In the known lamp, the indentation has a "pinch" or weakening portion for weakening the current-supply conductor the deformation of the contact pin during manufacture of the electric lamp. Said weakening portion makes an angle with respect to a longitudinal axis parallel to the contact pin. In addition, the indentation has a fixation portion for fixating the current-supply conductor in the contact pin.

The known capped electric lamp is a low-pressure mercury vapor discharge lamp, generally, having two contact pins at the lamp cap. In a low-pressure mercury vapor discharge lamp, mercury is the primary component for (efficiently) generating ultraviolet (UV) light. An inner wall of the discharge vessel may be coated with a luminescent layer comprising a luminescent material for converting UV to other wavelengths, for example to UV-B and UV-A for tanning purposes, or to visible radiation for general illumination purposes. In that case the low-pressure mercury vapor discharge lamp is also addressed to as fluorescent lamp. In an alternative embodiment, the ultraviolet light generated may be used for manufacturing germicidal lamps (UV-C). The discharge vessel of said low-pressure mercury vapor discharge lamps is generally tubular with a circular cross-section and includes both elongated and compact embodiments.

During indentation of the capped electric lamp an indentation tool (pen) is used which has a weakening part which makes the weakening portion of the indentation and which has a fixation part which makes the fixation portion of the indentation. The indentation tool is pressed against the contact pin in a direction transverse to the longitudinal axis, causing the contact pin to be deformed in an inward direction. During fixation the indentation tool into the contact pin, in particular, said weakening part has a tendency to become damaged easily, for instance by breaking off in part or wholly. Due to this breaking-off behavior the indentation is not provided in the contact pin as desired which may render the capped electric lamp no longer useful for delivery to clients.

It is an object of the invention to provide a capped electric lamp of the type mentioned in the opening paragraph, wherein said drawback is obviated.

According to the invention, a low-pressure mercury vapor discharge lamp of the kind mentioned in the opening paragraph is for this purpose characterized in that in that the indentation comprises a weakening portion for weakening the current-supply conductor during the manufacture of the electric lamp and comprises a fixation portion for fixating the current-supply conductor in the contact pin, and in that the weakening portion and the fixation portion of the indentation are substantially parallel to each other.

The indentation in the contact pin is formed in the course of the manufacture of the electric lamp by an inward deformation of the contact pin. In the known capped electric lamp, the weakening portion makes an angle with respect to the fixation portion of approximately 25–45° in such a manner that part of the weakening portion lies deeper in the contact pin. This means that the forces exerted on the weakening part of the indentation tool are relatively high with respect to those on the fixation part. By positioning the weakening portion and the fixation portion of the indentation substantially parallel to each other, this difference between the exerted forces is balanced.

A preferred embodiment of the capped electric lamp in accordance with the invention is characterized in that the indentation between the weakening portion and the fixation portion comprises a narrow portion which is relatively narrow as compared to the weakening portion and the fixation portion. This narrow portion allows the material of the contact pin which is deformed during fixation to flow away. In this manner the forces exerted on the pin during indentation differ as a function of the location in the indentation. At the

conductor is thicker than at the location of the weakening portion and at the location of the fixation portion.

The combination of the weakening portion, the fixation portion and the narrow portion causes a synergetic effect to be obtained. The weakening portion weakens the current-supply conductor upon indenting the contact pin, and the fixation portion causes the current-supply conductor to be fixed in the contact pin such that the end portion of the current-supply conductor can be readily pulled loose without the fixation of the current-supply conductor being substantially reduced. In addition, the narrow portion allows the material of the contact pin to flow away during fixation.

In order to balance the forces exerted on the indentation tool during fixation, the narrow portion, preferably, lies in a plane which also comprises the weakening portion and the fixation portion.

In order to allow the material in the middle of the indentation to flow away readily, the width of the narrow portion should be sufficiently small as compared to the width of the weakening portion. To this end, a preferred embodiment of the capped electric lamp in accordance with the invention is characterized in that the ratio of the width w_{np} of the narrow portion and the width w_{wp} of the weakening portion meets the relation:

$$0.2 \leq \frac{w_{np}}{w_{wp}} \leq 0.5 .$$

The width of the narrow portion should not be too small ($w_{np} \geq 0.2 \times w_{wp}$), otherwise the narrow part of the indentation tool becomes to vulnerable leading to a premature end of life for the indentation tool. On the other hand, the width of the narrow portion should not be too large ($w_{np} \leq 0.5 \times w_{wp}$), because then the flowing away of the material of the contact pin during fixation is hampered.

Similarly, in order to allow the material in the middle of the indentation to flow away readily, the width of the narrow portion should be sufficiently small as compared to the width of the fixation portion. To this end, a preferred embodiment of the capped electric lamp in accordance with the invention is characterized in that the ratio of the width w_{np} of the narrow portion and the width w_{fp} of the fixation portion meets the relation:

$$0.2 \leq \frac{w_{np}}{w_{fp}} \leq 0.5 .$$

A preferred embodiment of the capped electric lamp in accordance with the invention is characterized in that the ratio of the diameter d_{ind} of the current-supply conductor

at the location of the weakening portion in the indentation as compared to the diameter d_w of the current-supply conductor meets the relation:

$$0.2 \leq \frac{d_{ind}}{d_w} \leq 0.5,$$

The diameter of the current-supply conductor in the indentation should not be to small ($d_{ind} \geq 0.2 \times d_w$), otherwise the current-supply conductor would tend to break too easily. On the other hand, the diameter of the current-supply conductor in the indentation should not be too large ($d_{ind} \leq 0.5 \times d_w$), because then the weakening has not the desired effect, i.e. allowing the current-supply conductor to break while exerting a pulling force at the end of the current-supply conductor projecting from the contact pin, thereby removing the remainder of the current-supply conductor from the contact pin.

A preferred embodiment of the capped electric lamp in accordance with the invention is characterized in that the current-supply conductor in the contact pin does not extend beyond a boundary of the indentation that is furthest removed from the lamp cap. During manufacture of the capped electric lamp, the indentation tool provides an indentation in the contact pin. During fixation the current-supply conductor is weakened at the location of the weakening portion to such an extent that, upon exerting a pulling force on the end portion of the current-supply conductor projecting from the contact pin, the current-supply conductor breaks off at a predetermined location. By providing the current-supply conductor with a predetermined weakened portion, the current-supply conductor breaks off near the boundary of the indentation. After breaking off the current-supply conductor, the current-supply conductor no longer projects from the contact pin. As a result, cutting and/or filing of the end portion of the current-supply conductor projecting from the contact pin after fixating the current-supply conductor has become superfluous.

The combination of the weakening portion, the fixation portion and the narrow portion causes a synergetic effect to be obtained. On the one hand, the pinch portion weakens the current-supply conductor upon indenting the contact pin and, on the other hand, the press portion causes the current-supply conductor to be fixed in the contact pin such that the end portion of the current-supply conductor can be readily pulled loose without the fixation of the current-supply conductor being substantially reduced. To this end, the length of the press portion in the fixation area is preferably chosen to be such that upon pulling the end portion of the current-supply conductor from the contact pin, the current-supply conductor remains fixed in the contact pin

It is particularly favorable if the contact pin has only one indentation. This enables the pinch portion and the press portion to be provided in a single operation.

The measure in accordance with the invention can particularly suitably be applied to low-pressure mercury vapor discharge lamps comprising a capped electric lamp in accordance with the invention wherein the lamp vessel encloses a discharge space provided with a filling of mercury and an inert gas in a gastight manner, and wherein the electric element comprises an electrode arranged in the discharge space for maintaining a discharge in said discharge space.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

In the drawings:

Figure 1 is a side view of a capped electric lamp in accordance with the invention;

Figure 2A is a cross-sectional view of a contact pin of the capped electric lamp in accordance with the invention;

Figure 2B is a side view of the contact pin in Figure 2A, and

Figure 3 shows the pulling force as a function of the relative depth dimension of the indentation.

The Figures are purely diagrammatic and not drawn to scale. Particularly for clarity, some dimensions are exaggerated strongly. In the drawings, like reference numerals refer to like parts whenever possible.

Figure 1 shows diagrammatically the capped electric lamp comprising a light-transmitting lamp vessel 1 accommodating an electric element 2. A lamp cap 3 provided with a projecting contact pin 4 is secured to the lamp vessel 1. A current-supply conductor 5 connects the electric element 2 to the contact pin 4. The contact pin 4 is provided with an indentation 15 (see also Figure 2A and 2B) for fixating the current-supply conductor 5 in the contact pin 4. An alternative embodiment of the capped electric lamp is a compact fluorescent lamp.

The lamp shown in Figure 1 comprises two identical lamp caps 3, which each are provide by two contact pins 4, said lamp caps each being connected by a respective

conductor 5 to the electric element 2. The lamp shown is a low-pressure mercury vapor discharge lamp, wherein the lamp vessel 1 encloses a discharge space 9 containing a filling of mercury and an inert gas in a gastight manner. Preferably, the lamp vessel 1 is coated with a luminescent material (not shown in Figure 1). The discharge space 9 accommodates two electrodes, which serve as the electric element 2, and which can be heated by current passage in order to ignite the lamp and to maintain a discharge in the discharge space 9.

Figure 2A shows diagrammatically a cross-sectional view of a detail of the capped electric lamp in accordance with the invention shown in Figure 1. In addition, Figure 2B shows diagrammatically a side view of the contact pin in Figure 2A. The object in Figure 2A is rotated by 90° with respect to the longitudinal axis 11 in Figure 2A. In particular, Figures 2A and 2B show a contact pin 4 with a longitudinal axis 11, the current-supply conductor 5 being fixated. The contact pin 4 is unilaterally deformed in an inward direction, an indentation 15 being formed in the contact pin 4. As can be seen from Figure 2B the indentation is shaped like a diabolo or hourglass.

The indentation 15 comprises a weakening portion 16 for weakening the current-supply conductor 5 during the manufacture of the electric lamp and comprises a fixation portion 18 for fixating the current-supply conductor 5 in the contact pin 4. The substantially flat weakening portion 16 and the substantially flat fixation portion 18 of the indentation 15 are substantially parallel to each other. By positioning the weakening portion and the fixation portion of the indentation substantially parallel to each other the forces exerted on the weakening portion and the fixation portion are balanced during pressing.

Preferably, the indentation 15 between the weakening portion 16 and the fixation portion 18 is provided with a narrow portion 17 which is relatively narrow as compared to the weakening portion 16 and the fixation portion 18. This narrow portion allows the material of the contact pin which is deformed during fixation to flow away. Preferably, the narrow portion 17 lies in the same plane as the weakening portion 16 and the fixation portion 18.

Preferably, the ratio of the diameter d_{ind} of the current-supply conductor at the location of the weakening portion in the indentation as compared to the diameter d_w of the current-supply conductor meets the relation (see Figure 2A):

$$0.2 \leq \frac{d_{ind}}{d_w} \leq 0.5 .$$

In order to allow the material in the middle of the indentation 15 to flow away

the width w_{wp} of the weakening portion 16. Preferably, the ratio of w_{np} and w_{wp} meets the relation (see Figure 2B):

$$0.2 \leq \frac{w_{np}}{w_{wp}} \leq 0.5 .$$

Alternatively, the ratio of the width w_{np} of the narrow portion and the width w_{fp} of the fixation portion meets the relation:

$$0.2 \leq \frac{w_{np}}{w_{fp}} \leq 0.5 .$$

For a typical capped lamp, the width of the narrow portion w_{np} is in the range from 0.25 to 0.75 mm, whereas the width of the weakening portion and the fixation portion is in the range from approximately 1.0 to 1.5 mm.

In Figure 3, the pulling force F (in N) is shown as a function of the relative depth d_{pr}/d_{cp} of the indentation, wherein d_{pr} is the depth of the indentation 15 and d_{cp} is the diameter of the un-deformed contact pin 4 (see Figure 2A). The pulling force F is the force that is necessary to pull the end portion 51 of the current-supply conductor 5 loose from the contact pin 4. The relative depth d_{pr}/d_{cp} is also referred to as the pin-pinching depth. In Figure 3, three kinds of symbols are used:

(a) open squares: after pulling loose the end portion of the current-supply conductor 5, said current-supply conductor 5 can be moved in the contact pin 4;

(b) filled triangle: deformation of the contact pin has caused the current-supply conductor 5 to become detached on the side of the current-supply conductor 5 facing the lamp vessel 1;

(c) filled diamonds: the end portion of the current-supply conductor 5 breaks off and can be readily removed from the contact pin 4.

In connection with this, broadly three ranges can be distinguished in Figure 3:

(a) too small a pin-pinching depth: $d_{pr}/d_{cp} < 0.2$. At a pin-pinching depth below the above-mentioned limit, the end portion of the current-supply conductor 5 does not break off, but instead the current-supply conductor 5 moves in the contact pin 4.

(b) too large a pin-pinching depth: $d_{pr}/d_{cp} > 0.4$. At a pin-pinching depth above said limit, the end portion of the current-supply conductor 5 can be readily removed from the contact pin 4. However, during the deformation, the indentation formed in the current-supply conductor on the side facing the lamp vessel 1 is too deep, as a result of which the current-supply conductor 5 may become detached on the lamp side.

(c) a favorable pin-pinching depth: $0.2 \leq d_{pr}/d_{cp} \leq 0.4$. At a pin-pinching depth in between said limits, the superfluous end portion of the current-supply conductor 5 can be readily pulled loose and removed. The fracture in the current-supply conductor 5 occurs near the spot where the indentation 15 is maximal. The current-supply conductor 5 is sufficiently secured in the indentation 15 and there is no risk that the current-supply conductor 5 will be pulled loose on the side facing the lamp vessel 1.

Figure 3 shows, by means of vertical dotted lines, a very favorable range for the pin-pinching depth. In the range indicated by means of (i), the pin-pinching depth d_{pr}/d_{cp} meets the relation:

$$0.25 \leq \frac{d_{pr}}{d_{cp}} \leq 0.35$$

It will be clear that, within the scope of the invention, many variations are possible to those skilled in the art.

The scope of protection of the invention is not limited to the examples described herein. The invention is embodied in each novel characteristic and each combination of characteristics. Reference numerals in the claims do not limit the scope of the protection thereof. The use of the verb "to comprise" and its conjugations does not exclude the presence of elements other than those mentioned in the claims. The use of the article "a" or "an" in front of an element does not exclude the presence of a plurality of such elements.

CLAIMS:

1. A capped electric lamp comprising:
a light-transmitting lamp vessel accommodating an electrical element,
a lamp cap provided with a projecting contact pin having a longitudinal axis, which lamp cap is secured to the lamp vessel,
a current-supply conductor which is connected to the electrical element and to the contact pin,
an indentation being formed in the contact pin to fix the current-supply conductor,
characterized
in that the indentation comprises a weakening portion for weakening the current-supply conductor during the manufacture of the electric lamp and comprises a fixation portion for fixating the current-supply conductor in the contact pin,
and in that the weakening portion and the fixation portion of the indentation are substantially parallel to each other.

2. A capped electric lamp as claimed in claim 1, characterized in that the indentation between the weakening portion and the fixation portion comprises a narrow portion which is relatively narrow as compared to the weakening portion and the fixation portion.

3. A capped electric lamp as claimed in claim 2, characterized in that the narrow portion lies in a plane which also comprises the weakening portion and the fixation portion.

4. A capped electric lamp as claimed in claim 2, characterized in that the ratio of the width w_{np} of the narrow portion and the width w_{wp} of the weakening portion meets the relation:

$$0.2 \leq \frac{w_{np}}{w_{wp}} \leq 0.5.$$

5. A capped electric lamp as claimed in claim 1 or 2, characterized in that the ratio of the width w_{np} of the narrow portion and the width w_{fp} of the fixation portion meets the relation:

$$0.2 \leq \frac{w_{np}}{w_{fp}} \leq 0.5.$$

6. A capped electric lamp as claimed in claim 1 or 2, characterized in that the ratio of the diameter d_{ind} of the current-supply conductor at the location of the weakening portion in the indentation as compared to the diameter d_w of the current-supply conductor meets the relation:

$$0.2 \leq \frac{d_{ind}}{d_w} \leq 0.5.$$

7. A capped electric lamp as claimed in claim 1 or 2, characterized in that the fixation length l_f of the current-supply conductor in the contact pin is at least 0.75 mm.

8. A capped electric lamp as claimed in claim 1 or 2, characterized in that the current-supply conductor in the contact pin does not extend beyond a boundary of the indentation that is furthest removed from the lamp cap.

9. A capped electric lamp as claimed in claim 1 or 2, characterized in that the contact pin has only one indentation.

10. A capped electric lamp as claimed in claim 1 or 2, characterized in that the lamp has two lamp caps which are each provided with two contact pins.

11. A low-pressure mercury vapor discharge lamp comprising a capped electric lamp as claimed in claim 1 or 2,

wherein the lamp vessel encloses a discharge space provided with a filling of mercury and an inert gas in a gastight manner, and

wherein the electric element comprises an electrode arranged in the discharge space for maintaining a discharge in said discharge space.

ABSTRACT:

A capped electric lamp has a light-transmitting lamp vessel accommodating an electrical element and a lamp cap provided with a projecting contact pin (4). An indentation (15) is formed in the contact pin (4) to fix the current-supply conductor (5). According to the invention, the indentation (15) comprises a weakening portion (16) for weakening the current-supply conductor (5) during the manufacture of the electric lamp and comprises a fixation portion (18) for fixating the current-supply conductor (5) in the contact pin (4), wherein said weakening and fixation portion are substantially parallel to each other. Preferably, the indentation (15) comprises a narrow portion (17) between the weakening portion (16) and the fixation portion (18) which is relatively narrow as compared to the weakening portion (16) and the fixation portion (18).

Fig. 2A

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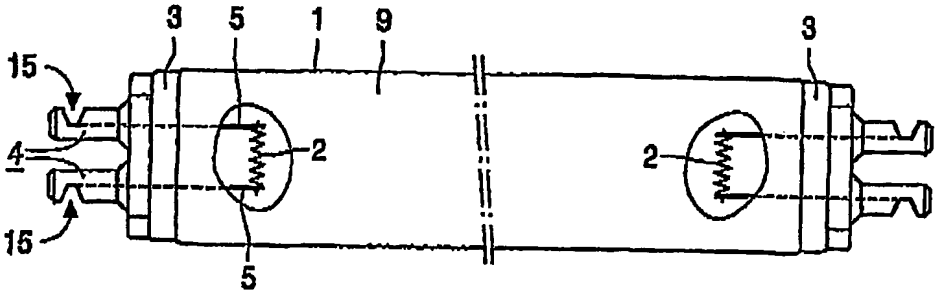
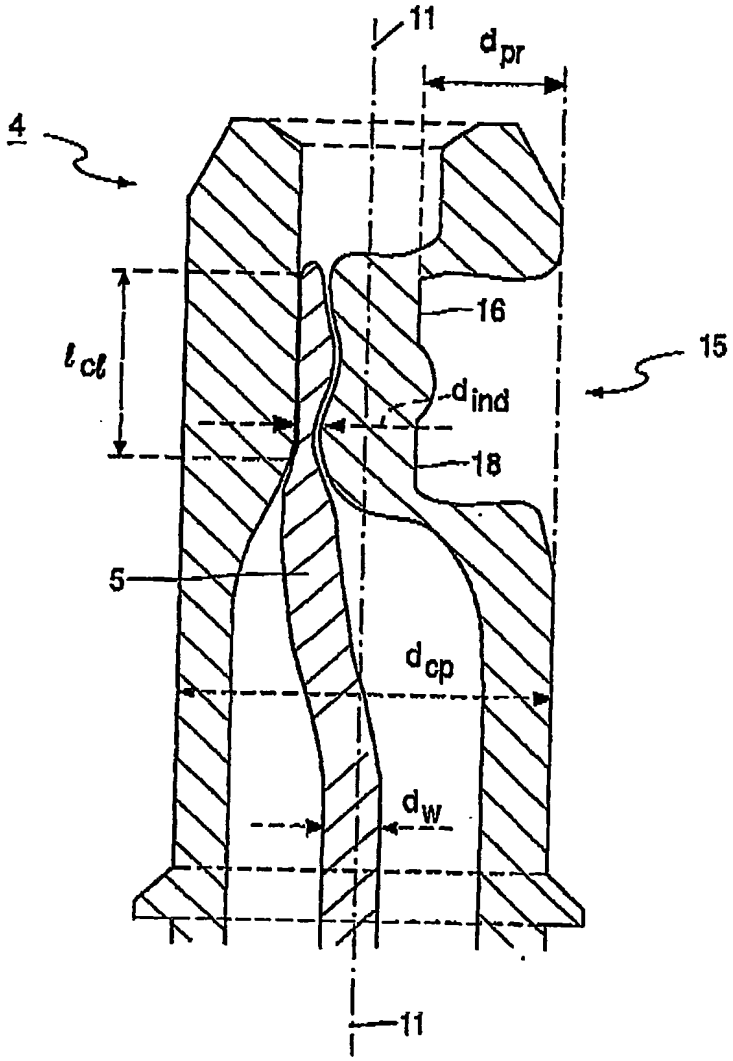


FIG. 1



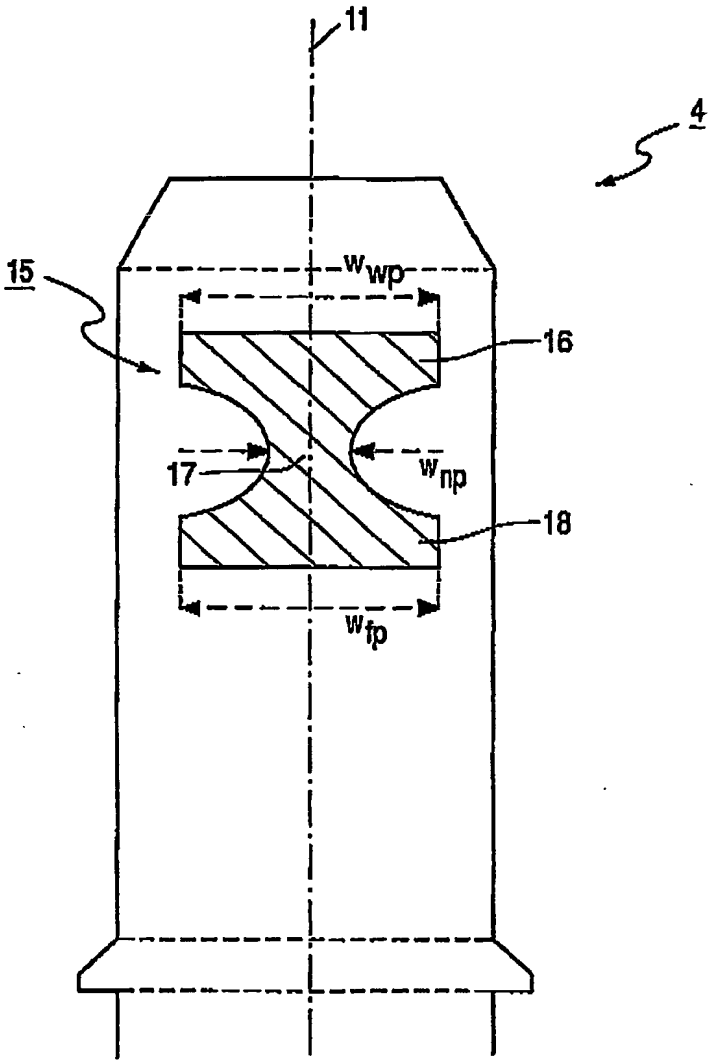


FIG. 2B

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FIG. 3